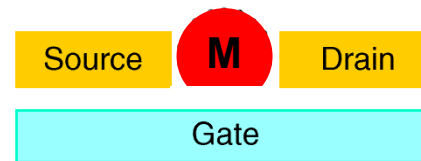
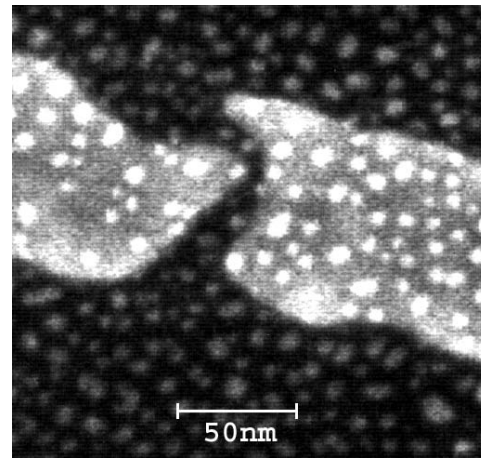


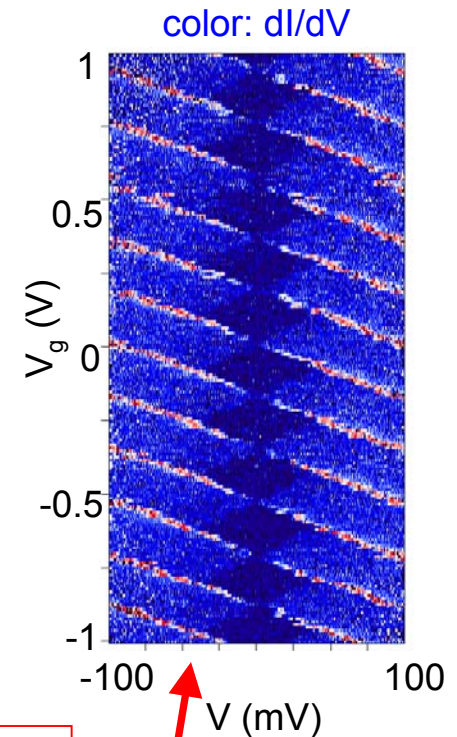
Electron Transport in Nanostructures and Single Molecules

Dan Ralph, Cornell University, **DMR-0244713**

We are developing and improving techniques to make nanometer-scale transistors in which electrons flow through individual quantum states. We have made transistors from single molecules and we are also producing more robust devices from metal nanoparticles. The challenge is to fabricate source, drain, and gate electrodes all in close contact to one nanostructure. The new lateral geometry pictured at left gives 10 times better control of quantum energy levels than any previous nanoscale transistor.



A single metal nanoparticle bridges between source and drain electrodes to make a nanoscale transistor.



Tuning over twelve charge states in one gold nanoparticle.

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Education:

Graduate Students: Jason Petta (postdoc Harvard physics), Mandar Deshmukh (postdoc Harvard chem), Ferdinand Kuemmeth. Undergraduate students: Marie Rinkoski (Oberlin College), Anika Kinkhabwala (Columbia), and Sara Slater (Cornell).

Serving as Director of Undergraduate Studies in the Cornell physics department. Special emphasis to have all undergraduate physics majors become involved in research.

Outreach:

Wrote “Ask a Scientist” columns for upstate NY newspapers on “Why does the Earth behave like a magnet?”, “How can electricity run things?”, and “Why are computer chips written on silicon?”

Participation by both the PI and students in “Marvelous Magnets” presentations, a three-hour family learning activity in which the properties of magnets are investigated in an interactive and approachable way by 5-9 year olds. (Picture at right.)

